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The Species of *Hermetia* of the *aurata* Group (Diptera: Stratiomyidae)

By Maurice T. James and Willis W. Wirth [1]

James (*in* Stone et al., 1965, "Catalog of the Diptera of America North of Mexico," Agric. Res. Serv. Handbook 276) listed *Hermetia aurata* Bellardi (with *H. a. eiseni* Townsend as a subspecies and *H. chrysopila* Loew as a synonym), as a single variable species with wide geographic distribution in the southwestern United States and Mexico. Though some spade work that had been done by Wirth indicated that the three forms were specifically distinct and, in addition, several undescribed taxa were involved, more time and specimens were necessary to resolve the problem. The present study is built upon this foundation and includes a preliminary key plus additional material that has been assembled from a number of collections: the United States National Museum, the American Museum of Natural History, the California Academy of Sciences, Cornell University, Ohio State University, Michigan State University, the University of Kansas, Kansas State University, Washington

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State University, Oregon State University, the University of Arizona, and the University of California at Berkeley, Davis, and Riverside. Holotypes and allotypes, unless otherwise stated, are in the United States National Museum.

Three names are currently available for species-level taxa in this complex, namely *H. aurata* Bellardi (type-locality Morelia, Michoacan, Mexico), *H. chrysopila* Loew (described from specimens from Texas in the Belfrage collection), and *H. eiseni* Townsend (described from the Eisen collection from southern Baja California, Mexico). These three are herein recognized as distinct species, contrary to the usage in the "Catalog." The seven new species described below, with two exceptions, show very close affinities with the above three and constitute a natural group of species that apparently is restricted geographically to Mexico and the southwestern United States. The two exceptions, *Hermetia anthidium* and *H. conjuncta*, can readily be added to the group by some extension of its definition; however, they undoubtedly are more remote from the complex that forms the core of the group. The eight species of the core complex, or at least seven of them, can be interpreted as a superspecies. Five of these—namely, *H. chrysopila*, *H. aurata*, *H. eiseni*, *H. ryckmani*, and *H. melanderi* (figs. 11, 12)—are completely allopatric in respect to one another. The distribution of *H. chrysopila* (fig. 11) is eastward from the front range of the Rocky Mountains and the Sierra Madre Oriental to the 95th meridian and between parallels 23° and 41° N; *H. melanderi* extends, west of the Rocky Mountains and Sierra Madre Occidental, from southeastern Arizona and southwestern New Mexico to northern Sinaloa; *H. ryckmani* occurs only in western Arizona and southern California; and *H. eiseni* occurs only in southern Baja California. Of the other three species, *H. nigricornis* and *H. subpellucida* are partially sympatric with each other and with *H. melanderi* but essentially allopatric with the other species, *H. subpellucida* extending only slightly into the range of *H. aurata*. The one known locality for *H. impressa* falls within the range of *H. aurata*. Male genitalia in the core complex are very homogeneous throughout; there is some variation from species to species, but variation within a species also occurs. It is possible that *H. impressa* should be excluded from the core complex, but its males, and consequently the male genitalia, are unknown.

Members of the group can be recognized readily by the combination of densely pilose eyes and the profile of the face: from the front view, the face is regularly rounded below; from the lateral view, it does not project conelike below the level of the eyes as is the case in most of the genus. *Hermetia anthidium* (fig. 1) is somewhat exceptional in

this respect although the projection of its face can hardly be considered conelike. *Hermetia hunteri* Coquillett has a rounded face but bare eyes, and its form, not to mention its genitalia, is so unlike members of the *H. aurata* group that it could not by any means be confused with them.

Other characteristics of the group are as follows: The frontal callus is represented by a bare, more or less triangular, area adjacent to each eye; above this, adjacent to the eye, the area is moderately to deeply depressed, at least lightly rugulose, usually deeply sculptured with irregular prominences or longitudinal carinulae (this term being applied to distinct and more or less sharply keeled ridges running lengthwise of the frons); between these areas and in front of the ocellar triangle there is a bulbous prominence, which we are designating the "ante-ocellar tubercle"; there is a small, flat callus, sometimes obscure or virtually wanting, just above the antennal bases (the supra-antennal callus). The wings are largely or wholly clouded, frequently with a yellow area, contrasting with the generally brownish clouding, extending at least across the stigma; vein R_{2+3} arises beyond cross-vein r-m; the wing is largely set with microtrichia, the basal part and at least a narrow anterior margin of cell 1st A being bare. The abdomen is ovate or elongated ovate, the sides of the second to fourth segments parallel, except in *H. anthidium* in which the abdomen is more rounded. The vestiture of the abdomen tends to form dense areas of long, appressed yellow to golden pile, particularly on the terminal terga; this pile is especially dense in such species as *H. aurata*. The genitalia (fig. 8) present a moderately uniform pattern with some variations. What we interpret to be the dististyle has migrated ventrad and laterad of the basistyle so as to appear like a lower lobe of the latter; from side view, in this group, we see chiefly the basistyle, with the dististyle ending far before the apex of the basistyle and appearing as a small angulated or rounded ventral projection (figs. 3–6).

Key to Species of the *Hermetia aurata* Group

1. Vanelike style of female flagellum (male unknown) acuminate, white at apex; abdomen short and robust, not much longer than wide, and black with narrow interrupted tegumentary yellow apical bands on terga 2 to 4. **anthidium James, new species**

   Vanelike style of female flagellum rounded at apex, sometimes acute but never acuminate and never white tipped; abdomen 1.5 to more than 2 times as long as wide and without tegumentary pale markings beyond the second tergum though the general coloration of the abdomen may be reddish . 2

2. Tibiae entirely yellowish, at most somewhat orange or orange yellow on apical third to half 3

   Hind tibia, at least, distinctly blackened or brownish black on apical third or more 5

3. Wing entirely grayish; mesonotal pile whitish in male to yellow or golden in female, uniformly colored, at most with a poorly defined presutural vitta that may be set off feebly by a very small amount of obscure, blackish pile; flagellum of antenna wholly black to base.
nigricornis James and Wirth, new species

Wing yellowish on part or all of anterior half; tibiae wholly yellow; antenna with base of flagellum distinctly yellow or, if entirely black, a distinct presutural vitta of golden pile present 4

4. Brassy pile of sublateral areas of second abdominal tergum forming a broad triangular area reaching almost to base of tergum and clearly visible as abdomen is rotated under light of varying incidence . . **chrysopila** Loew

Brassy pile of sublateral areas of second abdominal tergum limited to the posterior margin . . . . . **melanderi** James and Wirth, new species

5. Second abdominal sternum largely or wholly pale in contrast to preceding and following sterna, second tergum likewise largely pale or with two translucent spots 6

Second abdominal sternum largely concolorous with preceding and following sterna and not translucent; second tergum with at most indefinite, non-translucent pale areas 7

6. Abdomen more than twice as long as wide; second abdominal tergum with a pair of translucent spots, separated in the female but sometimes fused in the male; all tibiae largely black; mesonotal pile uniformly pale yellowish, without a presutural vitta; guards of aedeagus united ventrally, not terminating in setulae . . . . . **conjuncta** James, new species

Abdomen distinctly less than twice as long as wide; second abdominal tergum with a broad, trapezoidal, semipellucid area taking in a large part of the segment; only the hind tibia black or blackish apically; mesonotum with a median presutural vitta, usually set off by adjacent vittae of short, black pile; guards of aedeagus of the usual chrysopila group type, well separated ventrally and terminating in setulae.
subpellucida James and Wirth, new species

7. Frons with a prominent inverted U-shaped impression, particularly prominent at the anterior extremes of its arms just above the frontal callus, and shallowest where it crosses between the ocellar triangle and the ante-ocellar tubercle; all tibiae largely black . . . **impressa** James, new species

Frons laterad of ante-ocellar tubercle concave transversely but not deeply impressed, this concave area not extending conspicuously above the ante-ocellar tubercle; blackening of tibiae confined to apical half or third . . . 8

8. Scutellum yellow on posterior margin only; abdominal integument blackish, at most becoming reddish on parts of the terminal terga; dorsal abdominal pile dense, particularly in male, that of terminal two terga at least almost completely covering background . . . . . **aurata** Bellardi

Scutellum with distal half yellow; abdominal integument in male usually largely reddish or reddish brown on at least terga 3 to 5, less extensively or not at all reddish to reddish brown in female; abdominal pile less dense, the terminal terga by no means completely with background concealed . . . 9

9. Mesonotal pile wholly yellowish to whitish, the presutural vitta not at all differentiated in the female, but poorly differentiated in the male.
eiseni Townsend

Mesonotal pile yellow to golden, the presutural vitta well differentiated in both sexes and set apart from the other mesonotal pile by a vitta of black, pile on each side . . . . . **ryckmani** James and Wirth, new species

Hermetia anthidium James, new species

FIGURE 1

Female: Head black in ground color, copiously marked with yellow as follows: a rounded, slightly elevated spot on each side of the ocellar triangle and extending from the ocellar triangle to the eye margin; a transverse area including the two segments of the frontal callus and connecting them (but not as a callus), thence continuing as a narrow ocular orbit on each side below the eye; and a broader median area connecting broadly with the supra-antennal band and extending ventrad around the antennal bases and over the midfacies to the oral margin, becoming more whitish on the facial prominence; these yellow facial and supra-antennal areas isolate a broad, black, shining area on each side that extends from just above the antenna to the oral margin. Some short, stiff black pile on the ocellar triangle, that of head otherwise longer and yellow, rather dense. Ante-ocellar tubercle prominent, domelike, shining but with finely impressed, narrow striations running transversely in the median line and concentrically on the sides; area on each side above frontal callus punctate and only slightly rugulose and without distinct carinulae. Supra-antennal callus obscure, almost obsolete. Head measurements: Head width 3.25 mm, height 2.00 mm; frons at vertex 0.83 mm, at callus 1.33 mm; distance between eyes at oral margin 1.08 mm. Pile of eyes rather short, yellow, that above appearing black in some lights. Antenna as in figure 1; first and second segments yellow, the first blackish above, with black pile; flagellum brownish black, the style black, its acuminate tip broadly white and sharply contrasting with the rest of the flagellum; longitudinal groove of flagellum more conspicuous from inner but also quite apparent from outer surface. Proboscis yellow, the more strongly sclerotized areas black; pile yellow.

Ground color of thorax mostly black; humerus, postalar callus, a prealar spot on each mesopleuron, and apical two-fifths of scutellum yellow; dorsal pile black except a median presutural vitta, a triangular area on each side of it and reaching the humerus anteriorly, a transverse area just before the suture and reaching medially almost to the apex of the triangle on each side, a prescutellar band reaching from one postalar callus to the other, and a narrow band along the margin of the black area of the scutellum, golden; pile of metanotum black; that of pleura largely black; that of propleura and prosternum, posterior part of mesopleuron, most of sternopleuron, upper part of metapleuron, and apex of squama whitish. Coxae, trochanters and femora except extreme tips black, mostly black haired; tibiae and tarsi pale yellow, becoming whitish at bases of tibiae and on tarsi, white haired; apical two tarsomeres on all legs yellow with yellow hair,

claws becoming brownish at tips. Squamae dark brown. Wing infumated, more heavily so anteriorly than posteriorly; a broad longitudinal subhyaline area taking up all of second basal cell except its apex, the anterobasal part of the anal cell, and the bases of the fourth to second posterior cells, this area being devoid of microtrichia; the infumation posterior to and apicad of this area apparently due wholly to microtrichia and consequently not so intense as that anterior to it, in which the membrane is also infumated.

Abdomen short, slightly longer than wide (3.90 mm and 2.75 mm respectively); black, narrow apices of terga 2 to 5 and of sterna 1, 2, and 5, also narrow base of sternum 2, yellow, the bands tegumentary, those on terga 2 to 4 broadly interrupted medially; pile of first tergum and median part of second black, otherwise yellowish to brownish yellow, scattered and semi-erect on sterna 1 and 2, otherwise appressed. Ovipositor brown, terminal segment and cerci yellow. Length 7 mm.

Holotype: ♀, Barro Colorado Island, C.Z., Mar. 27, 1963, malaise trap, C. W. and M. E. Rettenmeyer; in the collection of Kansas State University.

The specific name was suggested by the resemblance to a megachilid bee of the genus *Anthidium*.

***Hermetia nigricornis* James and Wirth, new species**

FIGURE 4

Male: Head black; vertex, a pair of spots on each side of the ocellar triangle and usually confluent with the vertex, frontal callus, an indefinite area at antennal bases, and sides of face yellow, these areas usually more extensive than in the other species of this group. Ante-ocellar tubercle moderately prominent, shining, without striations; area above frontal callus rugulose but at most with only poorly defined carinulae; supra-antennal callus variable, usually small and poorly defined. Pile of head whitish. First and second antennal segments brown, the latter becoming brownish yellow, particularly at its apex; flagellum black to blackish to its base. Thorax black, humeri, postalar callus, and apical half of scutellum yellow; all thoracic pile uniformly whitish; no presutural vitta. Femora blackish; tibiae and tarsi wholly yellow, apical half of each orange yellow. Wing entirely grayish, apex and posterior half somewhat darker. Halteres yellow. Abdomen uniformly black but with a tendency to become reddish brown, particularly apically; second sternum with a transverse basal and a much smaller transverse apical pale area, these sometimes connected medially by a narrow vitta; pile of abdomen whitish dorsally and ventrally, some black pile, the exact amount variable, at base of first tergum; tergal pile moderately dense. Geni-

talia orange yellow; basistyle and dististyle as in figure 4. Length 8–11 mm.

Female: Similar to the male, but the dorsal pile is slightly to distinctly more yellow; the presutural vitta may be poorly defined or, as in the male, absent; most of the pile of the anterior half of the postscutum is short and black. In one paratype the mesonotal pile is golden and the presutural vitta, though feeble, is somewhat set apart by a few black hairs arranged so as to suggest lateral vittae.

Holotype: ♂, Florence Junction, Ariz., Apr. 21, 1935, F. H. Parker, Melander Collection; USNM type no. 69,103. Allotype: ♀, with puparium, Saguaro National Monument, Ariz., ex *Echinocereus*, Nov. 8, 1957, S. Alcorn; University of Arizona collection.

Paratypes: 2 ♂♂, same data as holotype. ARIZONA: 1 ♀, Pinal Mts., Aug. 4, 1939, F. H. Parker; 1 ♂, base of Pinal Mts., May 22, 1938, D. K. Duncan; 1 ♂, Ray, Apr. 18, 1957, F. H. Parker; 1 ♂, 15 miles south of Ray, May 4, 1961, R. H. and E. M. Painter; 2 ♂♂, Globe, Apr. 7, 1938, F. H. Parker, and August, D. K. Duncan; 1 ♂, Organpipe Monument, Alamo Canyon, Apr. 22, 1948, J. L. Sperry; 2 ♂♂ Sabino Canyon, Santa Catalina Mts., Apr. 6, 1955, F. G. Werner; 1 ♂, Oracle, Apr. 15, 1937, G. P. Engelhardt; 1 ♂, "Catal Spgs.," Apr. 14, 1898, E. A. Schwarz; 3 ♂♂, San Carlos Lake, April, D. K. Duncan; 1 ♂, Black Dyke Prospect, Sierritas, July 26–29, 1916, NEW MEXICO: 1 ♂, Jemez Springs, July 1, 1941, R. H. Beamer; 4 ♂♂, 1 ♀, Tajique, June 25, 1941, E. L. Todd; 1 ♂, Sandia Mts., May 22, 1948, L. S. Gordon; 1 ♂, "Monzano" [Manzano?], June 26, 1941, R. H. Beamer. TEXAS: 1 ♂, Boy Scout camp, south of Toyahvale, May 2, 1961, Killiam Roever. UTAH: 1 ♂, Beaver Creek Hills, Beaver Co.; 1 ♂, Beaver Valley. COLORADO: 1 ♂, Granite Peaks Camp, Bayfield; 1 ♂, Great Sand Dunes, Alamosa, Aug. 1, 1950, B. Rotger.

Hermetia chrysopila Loew

FIGURES 9, 11

Hermetia chrysopila Loew, 1872, Berliner Ent. Zeitschr., vol. 16, p. 56 (Centuria 10, no. 11).

Hermetia aurata Bellardi.—James, 1965, *in* Stone et al., Catalog of the Diptera of America north of Mexico, p. 304, partim [not Bellardi, 1859].

This species remains a variable one even though our concept of it is more restricted than that indicated in most of the literature. The vertex, except the ocellar triangle, is typically wholly yellow (sometimes a sordid or brownish yellow); the areas laterad of the ocellar triangle are elevated, somewhat tubercle-like, with fine lengthwise striations; the areas above the frontal callus are rugulose with two or three low but sharp irregular carinulae. The supra-antennal callus

is small but distinct and black. The mesonotum is mostly or wholly yellow to golden pilose, with a prominent median vitta, visible clearly without magnification, extending from the suture to a polished area on the anterior margin; the pile adjacent to this vitta is usually a pale yellow although in some specimens, particularly from the southern part of the range of the species (Texas and Mexico), the vitta is margined on each side by a distinct vitta of black hairs. The distributional pattern cannot, however, be interpreted as defining a subspecies since no exact geographic area is defined by it; indeed, both types occur in a series collected by R. H. and L. D. Beamer at Giddings, Tex. A tendency toward reddening of the abdomen in the male, particularly in Texan and Mexican specimens, is noticeable. The larger part of the abdomen is clothed with long, curved, appressed yellow to golden pile; this becomes less conspicuous in the more southern specimens. The male genitalia are similar to those of *H. melanderi* but the dististyle (fig. 9) has a different shape; its inner apical margin is always concave, sometimes deeply so, with a shoulder although the exact outline is subject to some variation; from lateral view the apex of the dististyle is angular in apical outline, forming an acute or right angle.

Geographical distribution (fig. 11): most or all of Kansas, except possibly the extreme eastern part, westward through Colorado to the front range of the Rocky Mountains and southward across Oklahoma and central Texas into northeastern Mexico. We have records from the following Mexican localities: Coahuila: Hermanas; Nuevo Leon: Monterrey, Vallecillo; Tamaulipas: Ciudad Victoria.

Hermetia melanderi James and Wirth, new species

FIGURES 6, 8, 11

Close to *H. chrysopila*, from which it may best be differentiated by the more limited amount of golden pile on the poterior margin of the second tergum; viewed from behind or medially, this pile is limited to a narrow patch, somewhat broadened sublaterally, on each side of the median line but separated from the whitish anterolateral pile of this tergum by a broad area of black pile, whereas in *H. chrysopila* these areas of golden pile extend in the form of a broad triangle almost to the base of the tergum. *Hermetia melanderi* can be separated from *H. chrysopila*, with exceptions as noted under the discussion of that species, by the more extensive black pile of the mesonotum, which includes a narrow vitta on each side of and isolating the presutural golden vitta and which takes in the anterior two-thirds of the postscutum. Also, in *H. melanderi* the eye pilosity is denser and longer than in *H. chrysopila*.

Male, female: Head, thorax and abdomen predominantly black. Yellow markings of head variable but basically consisting of a spot on each side of the ocellar triangle, the divided frontal callus, an indefinite area at base of antennae, and narrow facial orbits; anteocellar tubercle prominent; area above frontal callus coarsely rugulose and with a single broad carinula or with one more prominent than the remaining one or two; supra-antennal callus more prominent than in *H. chrysopila*, somewhat elevated. Humeri, postalar callus, and about apical half of scutellum yellow; halteres yellow; apices of femora, all of tibiae and tarsi, yellow, the apical half of each tibia becoming more orange yellow. Terga 1 and 2 mostly with short black pile; a fringe of yellow pile, usually interrupted medially, on tergum 1; an anterolateral triangle of thin yellowish pile and the patch of golden pile as described on tergum 2; remaining terga with conspicuous long appressed golden pile except for a sublateral triangle of black pile on each side of tergum 3 and a similar but less conspicuous triangle on tergum 4; venter white pilose. Male genitalia as in figures 6, 8. Length 9–12 mm.

Holotype: ♂, Globe, Ariz., Apr. 11, 1935, F. H. Parker; Melander Collection; USNM type no. 69,104. Allotype: ♀, same data, but May 1, 1935.

Paratypes: ARIZONA: 16 ♂♂, same data as type but Apr. 6, 7, and 8, 1935, and Apr. 7, 21, and May 1, 1938; 1 ♂, Globe, April, D. K. Duncan; 3 ♂♂, 3 ♀♀, Baboquivari Mts., Elkhorn Ranch, 4500′, Apr. 20, 1961, and Brown Canyon, Apr. 7, 1961, M. L. Noller, J. C. Bequaert; 2 ♂♂, 5 ♀♀, Baboquivari Mts., April, D. K. Duncan, Apr. 27, 1947, A. L. Melander, Apr. 28, 1935, F. H. Parker, and Apr. 4–19, 1937, W. Benedict; 2 ♂♂, 1 ♀, Madrona Ranger Station, Ricon Mts., May 15, 1964, at mud and water, M. L. Noller, J. C. Bequaert, M. Elton, M. Nurein, F. G. Werner, and May 22, 1964, Bequaert and Noller; 1 ♂, 1 ♀, Sabino Canyon, Santa Catalina Mts., Apr. 5 and 30, 1955, G. D. Butler; 1 ♂, Sabino Basin, Santa Catalina Mts., July 8–20, 1916; 3 ♀♀, Santa Catalina Mts., April, D. K. Duncan, and Apr. 9, 1955, Butler and Werner; 1 ♀, Canada del Oro, north of Santa Catalina Mts., Apr. 17, 1964, M. L. Noller, J. Burger, J. C. Bequaert, and F. G. Werner; 1 ♀, 10 miles north of Tucson, Apr. 21, 1957; 1 ♀, Madera Canyon, Santa Cruz Co., 4880′, July 15, 1963, V. L. Vesterby; 2 ♀♀, Pinal Mts., May 9, 1937 and May 6, 1940, F. H. Parker; 2 ♀♀, Portal, Cochise Co., June 28 and July 1, 1963, A. Laske; 1 ♀, Molino Basin, Mt. Lemmon, May 5, 1953, A. and H. Dietrich. NEW MEXICO: 1 ♀, Byer Spring, Florida Mts., 5000′. MEXICO: SINALOA: 1 ♂, 13 miles north of Culican, Mar. 17, 1962, F. D. Parker.

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***Hermetia conjuncta* James, new species**

FIGURES 7, 10

This species, particularly in the female, bears a close superficial resemblance to a rather small *H. illucens* (L.); it is distinctly more elongated than other members of the *H. aurata* group. The male genitalia are of the *H. chrysopila* type but differ from those of other known members of the group in that the guards of the aedeagus are fused and do not terminate in distinct setulae. A somewhat disturbing peculiarity in this species is the variability in the color of the pile, but this seems to indicate merely a certain amount of genetic instability within the species.

Male: Head black; yellow areas more reduced than in other members of the group and limited to the small frontal callus, a rounded spot on each side of the ocellar triangle, and a large transverse spot, behind the ocellar triangle and not reaching the eye, on the posterior part of the vertex and upper part of the occiput; face entirely black or with its prominence yellowish medially. Ante-ocellar tubercle glabrous, as large but not as prominent as in other members of the group; supra-antennal callus distinct, tubercle-like; area above frontal callus rugulose but without distinct carinulae. Pile of head yellow to whitish, tending to deeper yellow on lower face and on vertex, and in those areas with a variable, sometimes a considerable, amount, of black to blackish pile intermixed; eyes with long, dense, white to pale yellow pile. Antennae black, the second segment brownish to reddish yellow. Proboscis black. Thorax black, humeri, postalar callus, and sometimes extreme apical margin of scutellum brown; mesonotal pile uniformly reddish brown, no differentiated presutural vitta; a dense area of yellowish and whitish pile at apex of scutellum. Basal third of hind tibia yellow, femora and tibiae otherwise black except narrowly and indefinitely at knees. Tarsi pale yellow to clear yellow, becoming somewhat darker apically. Wing (fig. 10) gray but with a yellow area extending through second basal cell, across and including the entire discal cell, to the wing margin from stigma to vein R_4; area bare of microtrichia more extensive than usual for the group, vein Cu_2 being broadly bordered on both sides through much of the fifth posterior and first anal cells by the microtrichia-free area. Halteres orange, base of stalk more brownish. Abdomen black at base, at least the fifth and usually the fourth and part of the third segment, sometimes more, becoming reddish brown, more extensively so ventrally than dorsally; second segment translucent white on most of the sternum and on two large rectangular spots on the tergum, which are either separated from each other by a narrow black line or totally fused. Pile whitish at base and laterally

except that the parted pile of the first tergum may vary through yellow to golden and the translucent areas may bear some short black in addition to the pale hairs; pile of terga 3 to 5 dense; reddish brown, that of sterna 3 to 5 of variable color, sometimes largely black. Genitalia (fig. 7) reddish brown; dististyle concave on inner apical surface with several microdenticles, which are not visible from lateral profile. Length 10–11 mm.

Female: Closely similar to the male; pile of head more extensively white; thorax entirely black. Microtrichia-free area of wing much more extensive, taking in almost all the first anal cell, about half the second anal, and the upper basal part of the fifth posterior cell. Abdomen except translucent areas wholly black. Color of abdominal pile variable; in the allotype that of terga 2 and 3 and of sterna 4 and 5 short, black. Length 11–14 mm.

Holotype: ♂, Isthmus of Tehuantepec, Sumichrast, Mexico; USNM type no. 69,105. Allotype: Yautepec, Morelos, Mexico, July 31, 1963, F. D. Parker and L. A. Stange; University of California, Davis.

Paratypes: MEXICO: 3 ♂♂, same data as holotype; 2 ♂♂, same data as allotype. MORELOS: 1 ♂, Hujintlan, Aug. 22, 1956, R. and K. Dreisbach; 1 ♂, Lobo Canyon, 13 miles east of Cuernavaca, 3400′, Aug. 15, 1962, R. H. and E. M. Painter; 1 ♀, 5 miles east of Cuernavaca, July 16, 1963, Parker and Stange.

Hermetia subpellucida James and Wirth, new species

The coloration of the second abdominal segment will readily distinguish this species from all others in the complex except *H. conjuncta*, which would not be easily confused with *H. subpellucida* because of its *H. illucens*-like appearance and its much more slender abdomen. An occasional specimen of another species, for example a female *H. eiseni* or a slightly teneral *H. chrysopila*, may have a suggestion at least of a pair of pale tergal spots, but these are never subpellucid or transparent and do not involve the sternum, as do the subpellucid areas in *H. subpellucida* and *H. conjuncta*.

Male, female: Head black, frontal callus, narrow facial orbits, a pair of spots on each side of the ocellar triangle, and vertex, as usual, yellow to yellowish and, again, as usual for the group, subject to considerable variation as to the extent of the markings; in most specimens the spots beside the ocellar triangle are continuous with the vertex, forming one continuous area without indication of any division. Ante-ocellar tubercles smooth, without striations; area above frontal callus rugose with one to three, usually two or three, well-defined carinulae. Supra-antennal callus usually distinct but small, sometimes obscure. Mesonotum with a median presutural

vitta and a broad transverse prescutellar band of golden appressed pile; otherwise yellow pilose except usually, but not always, a band of black pile on each side of the median presutural vitta. Legs yellowish; femora blackish; hind tibia dark brown to black on apical third to fourth, at least externally. Wing yellow on about anterior half, including entire discal cell and extending beyond apex of vein R_5; posterior half brown; area devoid of microtrichia, limited, except at base, to anterior margin of anal cell. Abdomen black basally; tergum 2 largely pellucid yellow, only the broad lateral margins, broader anteriorly than posteriorly, black, the pellucid area consequently in the form of a trapezoid, this area sometimes darkened medially but not divided into two spots, as in *H. illucens;* sternum 2 wholly pellucid yellow or with only the lateral margins black; abdomen beyond second segment variable, largely or wholly black or blackish in the female, usually largely or wholly reddish, at least reddish on apical segments, in the male. Abdominal pile largely as in *H. chrysopila* but the golden pile in general less conspicuous; also terga 3 and 4, and to a lesser extent 5, with poorly defined sublateral triangles of black pile; a narrow transverse band of black pile at base of third tergum. Dististyle convex on its lower apical margin; from lateral view, it is rounded apically. Length 9–12 mm.

Holotype: ♂, Globe, Ariz., Sept. 9, 1941, F. H. Parker; Melander Collection; USNM type no. 69,016. Allotype: ♀, Skeleton Canyon, 6 miles southeast of Apache, Cochise Co., Ariz., Sept. 1, 1958, P. D. Hurd; University of California (California Insect Survey), Berkeley.

Paratypes: ARIZONA: 2 ♂♂, Globe, July 23, 1944, F. H. Parker, 3600′, mesquite, cholla, Aug. 6–9, 1948, W. Nutting; 1 ♀, 3 miles east of Portal, Cochise Co., Aug. 15, 1965, M. E. Erwin; 3 ♂♂, 17 miles east of Douglas, Cochise Co., Aug. 8, 1958, P. Opler, R. M. Bohart; 1 ♂, Leslie Canyon, Douglas, Aug. 16, 1931, Virginia Reed; 1 ♂, Cochise Stronghold, Sept. 6, 1960, L. A. Stange; 1 ♀, Molino Basin, Pima Co., Aug. 30, 1951, C. D. MacNeill; 1 ♀, Madera Canyon, Santa Cruz Co., 4800′, Aug. 5, 1963, V. L. Vesterby; 4 ♂♂, Baboquivari Mts., F. H. Snow, and July 19, 1950, L. D. Beamer, and July 18, 1950, J. Arnold; 1 ♂, Brown's Canyon, Baboquivari Mts., Aug. 18, 1955, F. G. Werner, G. D. Butler; 4 ♂♂, Santa Rita Mts., July 10, 1950, R. H. Beamer, and July 26, 1925; 1 ♂, Santa Rita Ranger Station, Pima Co., Aug. 8, 1957, C. W. O'Brien; 1 ♂, Florida Canyon, Santa Rita Range Refuge, Pima Co., July 20, 1959, G. A. Samuelson; 2 ♂♂, Safford, Sept. 6, 1955, R. W. Dawson; 3 ♂♂, Sabino Canyon, Santa Catalina Mts., Aug. 14, 1950, R. A. Beal, and Aug. 7, 1953, G. D. Butler; 1 ♀, Santa Catalina Mts., Aug. 22, 1954, G. D. Butler; 1 ♂, Cave Creek Ranch, Chiricahua Mts., 5000′, Aug. 3, 1965, G. R. Balmer; 2 ♀♀, Ramsey Canyon, Huachuca Mts., Sept. 6, 1956, F. G.

Werner, G. D. Butler; 9 ♂♂, 2 ♀♀, Tucson, Aug. 15, 17, 23, and 26, 1955 (one pair in copula), G. D. Butler, and Aug. 16, 1940, D. J. and J. N. Knull. NEW MEXICO: 2 ♂♂, Rodeo, Aug. 5, 1955, R. R. Dreisbach, and Aug. 7, 1958, R. E. Rice; 1 ♀, 3 ♂♂, 18 miles north of Rodeo, Aug. 25, 1958, P. M. Marsh, R. M. Bohart; 1 ♂, 19 miles north of Rodeo, Aug. 9, 1965, E. M. Brown. MEXICO: BAJA CALIFORNIA: 1 ♂, 15 miles south of Santo Domingo, Oct. 4, 1941, E. S. Ross, R. M. Bohart. SONORA: 2 ♂♂, 10 miles west of Alamos, July 21, 1954, M. Cazier, W. Gertsch, Bradts. SINALOA: 1 ♂, 30.5 miles north of Los Mochis, Aug. 24, 1964, M. E. Erwin; 1 ♂, 8 miles south of Elota, July 2, 1963. NAYARIT: 1 ♂, Ahuacatlan, July 18–22, 1951, on flowers of *Donnellsmithia hintoni* M. and C., P. D. Hurd.

It is noteworthy that this is a late summer and fall species, whereas the two that are largely sympatric with it, *H. melanderi* and *H. nigricornis*, are spring and early summer species.

Hermetia impressa James, new species

FIGURE 2

Differs from all other known species of the group in the deeply impressed sculpturing of the frons, as described below, and the divided ante-ocellar tubercle.

Male: Head black; a pair of spots posteriorly on the vertex, the lower facial orbits, frontal callus, and a small margin above each antennal base, yellow; a brownish spot below the ante-ocellar tubercle and, in the paratype, an indefinite spot of similar color on each side of the anterior ocellus. Frons deeply excavated by a broad trough or furrow beginning on each side between the triangle of the frontal callus and the ante-ocellar tubercle and continuing above the latter in the form of an inverted U, the ocellar triangle being broadly separated from the ante-ocellar tubercle by this trough; the usual area above the frontal callus with two strong glabrous carinulae and a weaker one between them, all running longitudinally of the frons; ante-ocellar tubercle glabrous, divided above by two transverse furrows, the lower the more prominent; supra-antennal callus distinct and glabrous; pile of head white. Eyes with short, dense black pile. Basal two antennal segments brownish yellow; flagellum dark brown, style black and black pilose. Proboscis brownish black with white pile. Thorax mostly black; middle of pronotum, humeri, and apical third of scutellum yellow; mesonotum with mostly golden pile, the presutural vitta and transverse prescutellar band well marked; a triangular patch above each wing base, a stripe to each side of the mesonotal vitta and turning J-like laterad so as partially to define an outer pair of vittae, and basal third of scutellum, black pilose;

sides of mesonotum before the suture and extending somewhat inward at the suture, as well as all pleural areas, white pilose. Anterior half of wing yellow to apex of discal cell and vein R_4, otherwise brown; microtrichia-free area in anal cell very narrow. Halteres yellow. Apical half of fore- and hind tibiae and apical two-thirds of middle tibia black. Abdomen mostly black, the apex becoming reddish brown; terga 4 and 5 and sternum 5 mainly reddish brown, with a black median triangle at base of tergum 4 and a black triangle on each side; pile of first and second terga black except for a large sublateral triangle of golden pile on each side of the second as in *H. chrysopila;* that of terga 3–5 dense, golden except a median and a lateral triangle on each side of each tergum, those on the fifth definitely the smallest, those on the third and fourth relatively large; venter white pilose. Genitalia yellow; dististyle prominent from lateral view, apex almost rectangular but slightly acute and sharp pointed. Length 8–9 mm.

Holotype: ♂, 6 miles south of Temixco, Morelos, Mexico, July 16, 1963, F. R. Parker, L. A. Stange; University of California, Davis.

Paratype: ♂, same data.

Hermetia aurata Bellardi

FIGURES 3, 12

Hermetia aurata Bellardi, 1859, Saggio di ditterologia messicana, vol. I, p. 27.—Williston, 1900, Diptera, *in* Godman and Salvin, Biologia Centrali-Americana, p. 240.—James, *in* Stone et al., Catalog of the Diptera of America north of Mexico, p. 304, partim.

Though we have not seen Bellardi's types, we feel confident that our interpretation of this species is correct. The type-locality is Morelia, Michoacan, Mexico, which fits well into the known distributional pattern of this species but not into any other member of the group with which it might be confused. As Williston points out, Bellardi makes no mention of a yellow border to the scutellum; specimens that we interpret to be *H. aurata* have the scutellum wholly black or with at most a very narrow yellow border, whereas in all other species of the complex the yellow area is prominent and may be extended to cover the apical half of the scutellum.

The supra-antennal callus is poorly developed or vestigial; the area above the frontal callus is rugulose, with two or sometimes only one well-marked carinulae. The thoracic pile is mostly yellow to golden and relatively inconspicuous except for the presutural median vitta, which is set apart by a vitta of black pile on each side, and a transverse prescutellar band; the hind tibia is black on the apical third to half, except at its extreme tip; and the others are reddish brown to dark brown or blackish on the same area; the pile of the ter-

minal abdominal terga is dense and golden. The abdomen usually is wholly black; sometimes, in the males, the terminal segment may become reddish brown, and occasionally a pair of pale, but not translucent, spots may appear on the second tergum. The male genitalia are reddish yellow to reddish brown; the basistyle is robust; the dististyle, from ventral view, oval, its apex, when viewed laterally being rounded and projecting only very inconspicuously (fig. 3).

Geographic distribution (fig. 12): Southern Sinaloa (Elota, Mazatlan) to Durango and San Luis Potosi (Ciudad del Maiz) south to Oaxaca (Oaxaca, Camaron) and Guerrero (Amula, Venta de Zapilote, recorded by Williston, 1900). We have records from the following Mexican states within the above distributional area: Zacatecas, Aguascalientes, Nayarit, Guanajuato, Jalisco, Michoacan, Morelos, Veracruz, and Puebla. Seasonal records run from March to late October; however, this may merely reflect lack of collecting during the winter months.

Hermetia eiseni Townsend

FIGURE 11

Hermetia eiseni Townsend, 1895, Proc. California Acad. Sci., ser. 2, vol. 4, p. 594.
Hermetia aurata Bellardi.—Townsend, 1895, Proc. California Acad. Sci., ser. 2, vol. 4, p. 594 [not Bellardi].
Hermetia aurata ssp. *eiseni* Townsend.—James, *in* Stone et al., 1965, Catalog of the Diptera of America north of Mexico, p. 304, partim.

The supra-antennal callus is distinct and the area above the frontal callus rugulose, with two rather low carinulae; the mesonotum is wholly whitish to yellowish pilose, the pile thin except on the prescutellar band; a narrow presutural vitta is present in the male but absent in the female. The wing is brown with a yellow area extending the length of the second basal cell across the discal cell to the anterior margin and apex of vein R, so that both the posterior half of the wing and the anterior margin to the stigma remain brown; the differentiation in color is more marked in the female than in the male. The hind tibia is blackish to black on its apical third to half, the others reddish brown in the same area. The abdomen, at least when viewed from behind, is reddish brown in both sexes, the color more reddish in the male; however, the yellow pile of the abdomen is not as prominent as in *H. chrysopila*, more nearly comparable to *H. ryckmani*, and each tergum bears a broad transverse band of black pile, the yellow pile usually being limited to the extreme base and the apical half of the tergum. The male genitalia are similar to those of *H. ryckmani*.

So far as we know, this species is restricted to the southern part of Baja California (fig. 11), and other records in the literature pertain to other species. Townsend's types came from San Jose del Cabo and

El Taste; he also recorded a series of 34 specimens of *H. aurata* from the former locality. We have examined one male and four females from San Jose del Cabo and one male from El Taste, all Eisen Collection, also one female from Todos Santos, W. M. Mann. These seem to be conspecific, in spite of the differences between the sexes as indicated in the above description. Townsend made no mention of the sex of any of his specimens of either *H. eiseni* or what he took to be *H. aurata;* apparently he interpreted the males of the series as *H. aurata* and the females as the new species that he described as *H. eiseni.*

Hermetia ryckmani James and Wirth, new species

FIGURES 5, 11

Hermetia aurata eiseni Townsend.—James, 1960, Bull. California Ins. Surv., vol. 6, p. 111; James, 1965, *in* Stone et al., Catalog of the Diptera of America North of Mexico, p. 304, partim.

Hermetia aurata Bellardi.—McFadden, 1967, Proc. U.S. Nat. Mus., vol. 121, no. 3569, p. 32.

Male: Head black, vertex, frontal callus, and sides of face, as usual, yellow; pile of head yellow, that of face more whitish, that of eyes dense, black above, brownish black below. Area above frontal callus, on each side, with two or three well-defined carinulae and rugulose, the sides of the front below these and the ante-ocellar tubercle distinctly but only moderately concave; ante-ocellar tubercle moderately prominent, smooth, sometimes with a few punctures above, not striate or but feebly longitudinally; supra-antennal callus small but distinct, glabrous. First two antennal segments and base of flagellum yellow, flagellum gradually becoming brownish yellow toward style, style black. Proboscis brown with white hairs. Thorax black, humeri and apical two-fifths to half of scutellum yellow. Presutural median vitta of mesonotum and transverse prescutellar band consisting of golden pile; a vitta of short pile to each side of presutural vitta and short pile of basal half of scutellum black; other thoracic pile yellow, tending to whitish or whitish yellow on the pleura. Anterior part of wing yellow to apex of vein R and including discal cell, the stigma, however, more brownish; area devoid of microtrichia limited to the basal cells and the narrow anterior part of cell 1st A. Tibiae and tarsi yellow, hind tibia black to blackish on apical fourth to third, fore- and midtibiae orange yellow on approximately apical half. Abdomen mostly reddish brown, first segment dorsally and ventrally and usually part of second black to blackish, rarely third segment somewhat blackish; a yellow transverse spot at base and a smaller one at apex of second sternum, usually connected by a median line. Pile of first and second terga black; a small apical fringe of golden pile

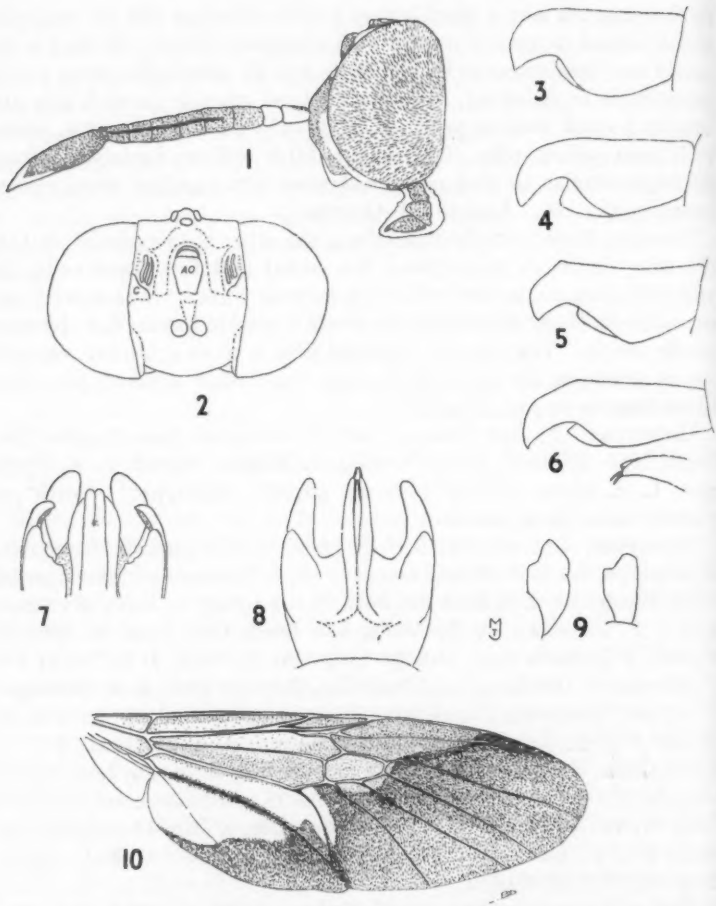
on first tergum and a small apical patch of similar pile on each side of the second; terga 3–5 mostly with appressed golden pile that is not nearly so conspicuous as in *H. aurata* and *H. chrysopila*, more nearly comparable to *H. eiseni*; a small sublateral triangle on each side and usually a small median patch of black hairs on terga 3 and 4; sterna with pale yellow pile. Genitalia reddish yellow; basistyle robust, dististyle similar to that of *H. melanderi* but rounded when viewed laterally (fig. 5). Length 11–14 mm.

Female: Differs chiefly from the male, other than sexually, in that the wing is brown throughout the costal and first basal cells, the yellowish area consequently forming a streak through the second basal, across the discal cell and to the apex of vein R, and in having the abdomen wholly black. The black of the hind tibia is more extensive, occupying as much as the apical half; even the darker areas of the other tibiae may be in part blackish.

Holotype: ♂, San Dimas Canyon, Pomona, Los Angeles Co., Calif., Nov. 23, 1960; host: *Opuntia occidentalis*, reared; R. E. Ryckman, L. E. Olsen; USNM type no. 69,107. Allotype: ♀, with puparium, same data, but Dec. 4.

Paratypes: CALIFORNIA: 5 ♂♂, 12 ♀♀, 5 with puparia, same data as holotype, but Nov. 23 and Dec. 4; 1 ♂, 3 ♀♀, same data, but Apr. 16, 1958, Ryckman, and June 10, July 24, and Aug. 1, 1958, Ryckman and J. P. Fonseca; 1 ♀, La Jolla, San Diego Co., June 18, 1963, J. Powell; 1 ♀, Santa Ana, Orange Co., Sept. 1, 1959, J. L. Bath; 1 ♀, 1 mile east of Del Mar, San Diego Co., July 17, 1963, E. I. Schlinger; 1 ♂, San Diego Co., bred from decaying cactus, Sept. 5, 1919, F. Psota; 2 ♂♂, San Diego Co., no date and Aug. 22, 1921; 2 ♂♂, Los Angeles, June 3, 4, 1909, F. C. Pratt, on *Opuntia*; 1 ♀, Los Angeles Co., July; 1 ♂, Los Angeles Co., June 18, Coquillett; 1 ♀, Filmore, June 27, 1937, B. E. White; 2 ♂♂, San Diego, July 13 and Aug. 20, 1921; 3 ♂♂, California, no other data. ARIZONA: 1 ♂, Congress, Aug. 13, 1939, K. Stager.

The puparia described by McFadden (1967, p. 32) were taken from the type series of this species.



FIGURES 1–10.—*Hermetia anthidium:* 1, head, lateral view (pile omitted except on eyes). *Hermetia impressa:* 2, head, front view, semidiagrammatic (AO=ante-ocellar tubercle; C=frontal callus; the U-shaped trough between these structures and above the ante-ocellar tubercle is set off by lines of short dashes). Male dististyle and basistyle, lateral view: 3, *Hermetia aurata;* 4, *H. nigricornis;* 5, *H. ryckmani;* 6, *H. melanderi* (and offset, apex of aedeagus). *Hermetia conjuncta:* 7, male genitalia, ventral view (basal part omitted, vestiture omitted). *Hermetia melanderi:* 8, male genitalia, ventral view (vestiture omitted). *Hermetia chrysopila:* 9, male dististyle, lateroventral (left) and ventral view (right). *Hermetia conjuncta:* 10, wing. (Fig. 10 drawn by Francoise Demogeot; others by M. T. James.)

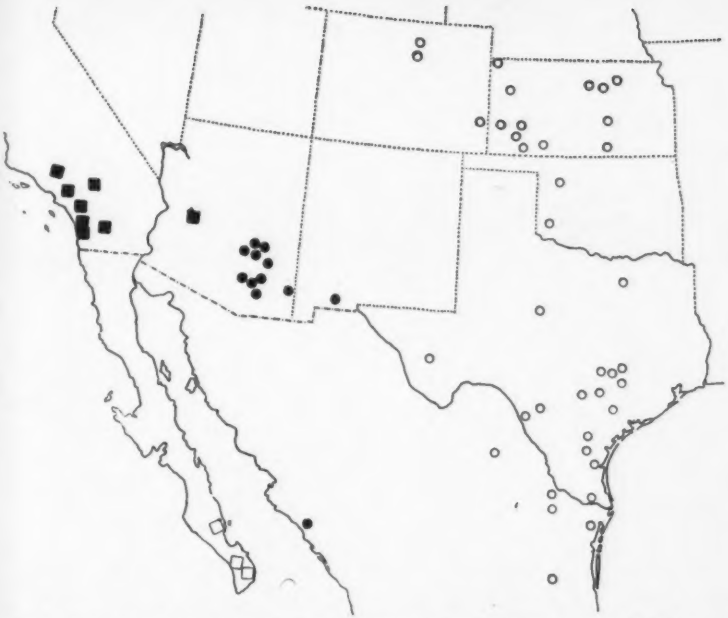


FIGURE 11.—Geographic distribution of *Hermetia chrysopila* (open circles), *H. melanderi* (solid circles), *H. ryckmani* (solid squares), and *H. eiseni* (open squares). (Drawn by Francoise Demogeot.)

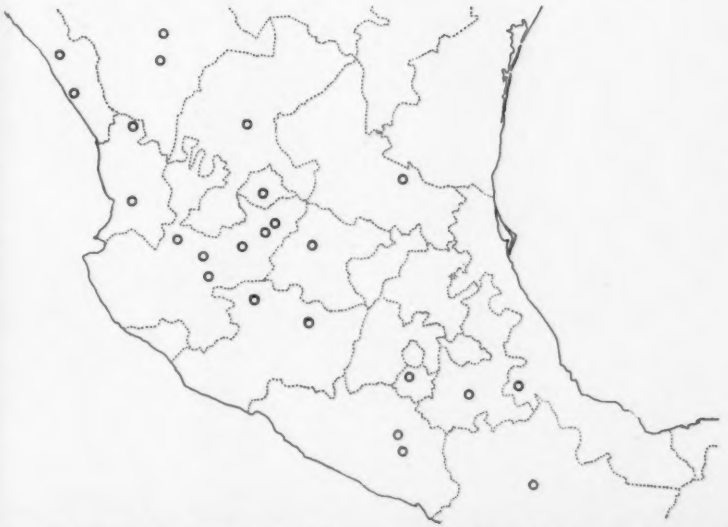


FIGURE 12.—Geographic distribution of *Hermetia aurata*. (Drawn by Francoise Demogeot.)

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